



# high availability: the IT imperative

## Enhancing HP ProLiant servers with innovative technologies

Organizations are under growing pressure to support non-stop business operations without increasing the IT budget. Given their position at the center of the IT infrastructure, servers play a critical role in determining both the overall availability as well as the total cost of ownership of that infrastructure.

To ensure high availability, a server must proactively respond to failures, both within the server and the network to which it is attached. High availability requires that a system administrator manage a server without having to be colocated with that server, and that the server remain available while a failed component is repaired.

**Intel® PRO**  
Network Connections

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## many factors combine

to influence server availability. HP and Intel are developing sophisticated technologies like redundant Ethernet connections and network adapter teaming that enhance server availability and enable IT organizations to satisfy today's business requirements.

### redundant Ethernet connections

Server adapters act as an interface between the server and the network. Therefore, they play a critical role in determining server availability and performance.

Some server adapter features are based on industry standards. These include flow control (IEEE 802.3x\*), VLAN tagging (IEEE 802.1Q\*) and link aggregation (IEEE 802.3ad\*). Other influences are vendor specific, such as the amount of onboard memory and the operating systems supported.

To address slot-constrained environments, server adapters offer multiple ports. *Multiple port server adapters* allow IT organizations to meet current demands like segmenting the LAN to reduce network bottlenecks. In addition, multiple port server adapters enable fault tolerance to maintain server availability by rerouting traffic to another port if a problem develops on the network.

Multiple port server adapters enable

- IT organizations to respond to industry trends, such as server consolidation and virtualization, that are driving the need for more network ports. These are also required to accommodate virtual servers while supporting segmentation and fault tolerance.

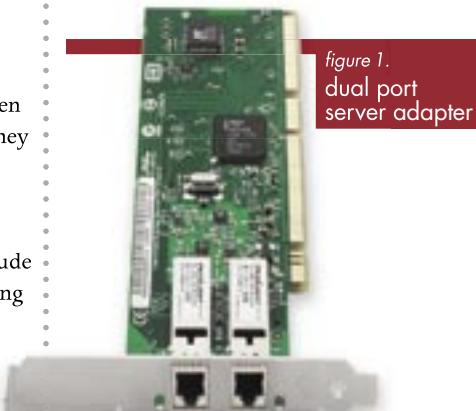


figure 1.  
dual port  
server adapter

- ProLiant servers support multiple port server adapters. The HP NC6170 and NC7170 Gigabit Ethernet server adapters with Intel technology offer 128 KB of onboard memory, which leads to enhanced performance. Flexibility is increased because these adapters support copper and fiber optic interfaces, as well as Ethernet, Fast Ethernet and Gigabit Ethernet connections. The HP NC6170 and NC7170 improve scalability by doubling the number of ports that a given server can support.

## ProLiant Essentials Intelligent Networking Pack

The ProLiant Essentials Intelligent Networking Pack (INP) enhances basic network adapter teaming by providing additional redundancy and load balancing. Teaming is taking two to eight NIC ports and configuring them to function as if they were a single NIC in order to provide network fault tolerance and to increase bandwidth. Basic network adapter teaming detects server downtime and network bottlenecks up to the first switch connection. INP resides at server nodes and enables the server to detect the network infrastructure from the first tier of switches and beyond. As network conditions change, the INP monitors and analyzes the network conditions, and redirects traffic to the optimum path. Additionally, INP helps slow down the spread of viruses by monitoring the behavior of all outbound connection requests. INP offers three key advanced networking features—active path failover, fast path failover, and dual channel teaming—plus the business protection feature of virus throttle.

Active path failover allows a ProLiant server to maintain connectivity with the core network even if the link between the intermediate switch and the core network has failed. When active path failover is configured, the ports in a team continually

## 64-bit Intel® Xeon™ processors: high availability building blocks

today's business requirements demand IT organizations deploy servers that are designed to be powerful, reliable and highly available. Leading technologies like redundant Ethernet connections, network adapter teaming, memory management and Smart Array controllers enable improved flexibility and broad software compatibility. These innovations offer IT professionals the tools to effectively address high-availability platform challenges, both now and in the future.

### high availability, power savings and higher performance

64-bit Intel® Xeon™ processor-based platforms are highly available because they incorporate technologies such as redundant DIMMs (dual inline memory modules), memory

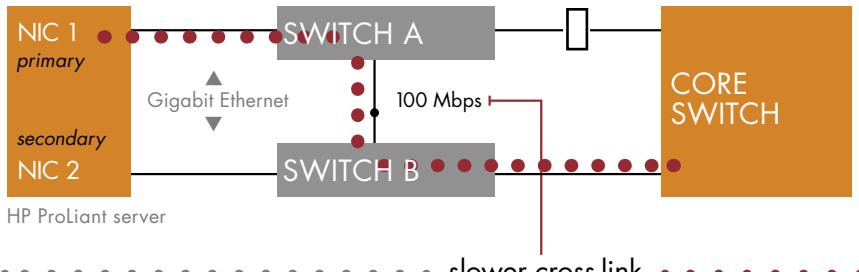
scrubbing and RAID controllers on the motherboard. Enhanced Intel SpeedStep® technology and DDR2-400 memory support help reduce power and cooling costs by using advanced power-management techniques. Server performance is improved by technologies such as Intel® EM64T, Enhanced Intel SpeedStep technology, Hyper-Threading Technology, PCI Express\* and Intel NetBurst® microarchitecture.

With a history of technology innovation and a broad base of hardware, software and integration leaders, Intel consistently delivers enterprise-class performance, quality and availability. This approach helps you to build for the future with confidence on a platform that evolves as your business grows.

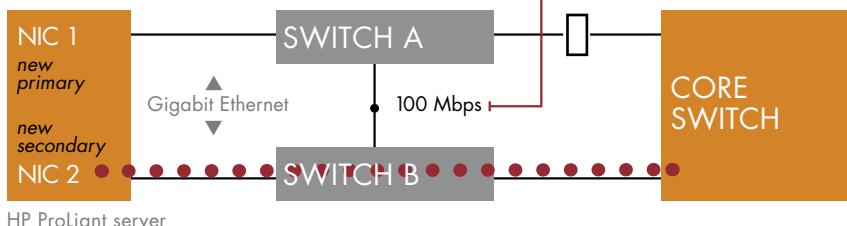


figure 2. fast path failover

FAILURE: team's primary NIC has 100 Mbps path to core switch



RECOVERY: team's new primary NIC has gigabit path to core switch



monitor for connectivity to the core network. The primary path automatically fails over to the secondary path as soon as it senses a loss of connectivity.

Fast path failover determines the fastest path to the core switch to help maximize network performance and availability by identifying network path degradation. For example, fast path failover would detect if the Gigabit Ethernet connection from an access switch to a core switch fails and the traffic is re-routed over a 100-Mbps Ethernet connection. It would then fail the traffic over to an alternative Gigabit Ethernet connection.

Dual channel teaming allows system administrators to create a team of NICs that support receive and transmit load balancing, and provides switch redundancy. This combination of capabilities is not available with any other basic team types such as switch-assisted load balancing (SLB) or transmit load balancing (TLB). With dual channel teaming, two NIC teams appear as a single connection to the server. If one of the switches fails, there is no loss of connectivity and the failed switch can be replaced without affecting server traffic.

Virus throttle can slow down the spread of virus, leaving time for IT intervention before the entire network becomes infected. Traditional approaches to anti-viral protection are based on the actual code or signature of the virus. Virus

- throttle identifies viruses on the basis of their behavior. Because it works without knowing anything about the virus, it can handle unknown virus without waiting for signature updates.

### virtual presence

HP's *Integrated Lights-out (iLO)* technology reduces cost and increases server availability by giving an IT organization a virtual presence within the data center as well as on any remote system. That means no matter where the server is located, the IT organization has control over the key system resources such as the console, keyboard, mouse and power. Using iLO, an IT organization even has the ability to make storage media appear local to the server. In addition, iLO continues to operate even if the server's operating system is not functioning.

IT organizations can use iLO to install, configure, monitor, update and troubleshoot remote ProLiant servers from a standard web browser, command line or script without requiring any additional software on the client system. iLO is integrated with other management tools, making it easier to combine virtual presence capabilities with other server lifecycle management tasks from deployment to ongoing administration.

### memory protection technologies

ProLiant servers use a variety of techniques to protect against errors, and hence increase availability. For example, HP was one of the first companies to introduce advanced memory protection technology such as *ECC (Error-Correcting Code) memory, online spare memory, mirrored memory and RAID memory* in industry-standard servers.

To improve memory protection even further, HP introduced *Advanced ECC technology*. Advanced ECC technology is capable of correcting a multi-bit error that occurs within one dynamic random access memory (DRAM) chip.

The ProLiant server online spare memory determines if an active DIMM (dual inline memory module) exceeds a predefined error threshold. The error will be corrected and the data from the entire bank that contains the failed DIMM will be copied to online spare memory. The failed bank is deactivated, but the server will remain available until the failed DIMM is replaced during a scheduled shutdown.

Whereas online spare memory mode protects against single-bit errors and entire DRAM failure, mirrored memory mode enables full protection against single-bit and multi-bit errors. In mirrored memory mode, the same data is written to both system memory and mirrored memory banks, but data is read only from the system memory banks. If a DIMM in the system memory banks experiences a multi-bit error or reaches the pre-defined error threshold for single-bit errors, the roles of the system and mirrored memory banks are reversed.

HP is one of the first companies to support *hot plug RAID memory*, which allows the memory subsystem to operate continuously even in the event of a complete memory device failure. In this context, RAID stands for *Redundant Array of Industry-standard DIMMs*.

Hot plug RAID memory generates parity for an entire cache line of data during write operations and records the parity information on a dedicated parity cartridge. However, hot plug RAID memory does not have the mechanical delays of seek time, rotational latency and bottlenecks associated with disk drive arrays.

## cooling & power

There are two types of cooling redundancies. One allows users to run their server until they shut it down and replace the failed fan. The other maximizes server availability by permitting the failed fan to be changed while the system is still functioning.

HP performs hundreds of system tests on each of its ProLiant servers. During these tests, the fans are independently stress tested. For greater reliability, only fans with ball bearings are used. HP servers include counter-rotating fans with fixed stators, designed to produce greater airflow at higher flow impedances and a more uniformly directionalized airflow.

ProLiant servers allow the addition of a *redundant power supply*, or removal of an existing redundant power supply for servicing at any time without interrupting server operation. Having a redundant power supply protects the server against the failure of a power supply, as well as the failure of the AC line cord. When a server is equipped with two power supplies, each provides approximately half of the power required by the system. This helps to reduce component stress, which enhances overall reliability.

## Smart Array controllers

In this context, RAID refers to *Redundant Array of Independent Disks*. RAID technology allows a group of disk drives to be tied together to function as a single logical disk drive, providing increased performance and availability.

HP's *Smart Array controllers* are integrated on ProLiant servers, and support a variety of RAID types including *RAID 1+0* and *RAID 5*. Developed and patented by HP, *RAID 6 Advanced Data Guarding (ADG)* is further supported on Smart Array controllers. This technology creates two sets of parity striped data across the disks to help ensure the system can withstand multiple disk failures without data loss. RAID ADG enables high levels of fault tolerance in a cost-effective manner.

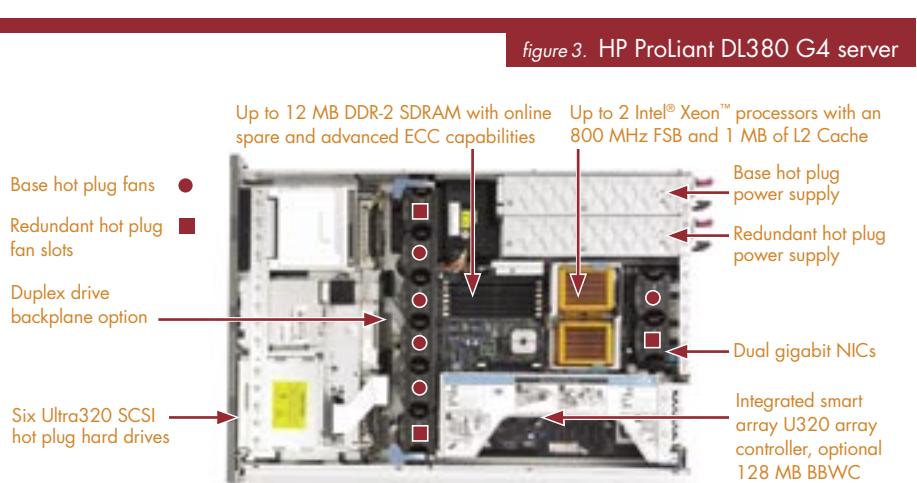


figure 3. HP ProLiant DL380 G4 server

A RAID array controller will store data temporarily in cache memory during data transfers. If a power interruption occurs after data has been written to cache memory and before it is written to a disk, the cached data will be lost. To avoid this problem, HP's Smart Array controllers support *redundant*

adapters, and advanced network adapter teaming capabilities such as fast path failover.

Highly available servers also require functionality such as HP's industry leading memory protection and Smart Array controllers, as well as advanced cooling and power technologies. And remote

figure 4. RAID selection guide

MOST IMPORTANT	SECONDARY IMPORTANCE	RAID LEVEL CHOICE
<b>Cost Effectiveness</b> (cost per usable capacity)	fault tolerance ► performance ►	RAID 6 (Advanced Data Guarding from HP) RAID 5 (RAID 0 if fault tolerance is not needed)
<b>Fault Tolerance</b>	cost effectiveness ► performance ►	RAID 6 (Advanced Data Guarding from HP) RAID 1+0
<b>Performance</b>	cost effectiveness ► fault tolerance ►	RAID 5 (RAID 0 if fault tolerance is not needed) RAID 1+0

battery-backed cache, providing battery backup for up to four days. Once the power has been restored, the data in the cache is then moved to a disk.

management capability allows the user to quickly address server requirements from any location. These features ensure that HP ProLiant servers provide the availability required by today's business environment.

## making the right choices

Companies of all sizes and industry types are increasingly adopting a non-stop approach to business operations. To support this approach, IT organizations must continually improve component availability.

HP (NASDAQ "HPQ") is a technology solutions provider to consumers, businesses and institutions globally. The company's offerings span IT infrastructure, global services, business and home computing, and imaging and printing.

HP ProLiant servers are the cornerstone of a reliable IT infrastructure. When selecting a server, IT organizations should look for features like redundant server

Intel (NASDAQ "INTC"), the world's largest chip maker, is also a leading manufacturer of computer, networking and communications products.

For more information on ProLiant servers and increasing server availability, visit [www.hp.com/go/proliantavailability](http://www.hp.com/go/proliantavailability) or call 1-866-625-4090